

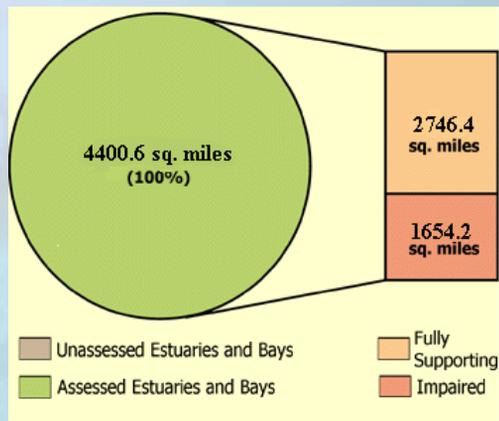
# Estuary Degradation in Texas

## Issues and Recommendations

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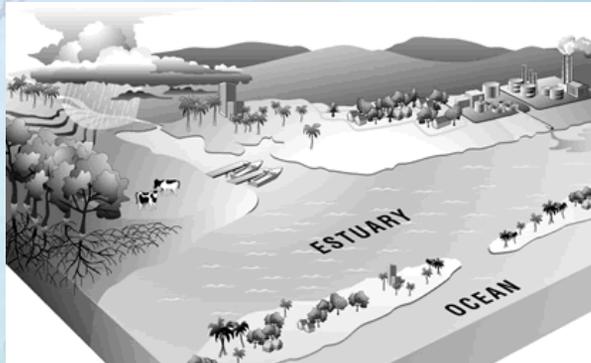
## Texas Coastline

- Wetlands
  - 2575 sq. mi.
- Open Bays
  - 1990 sq. mi.
- Estuaries
  - 2410 sq. mi.

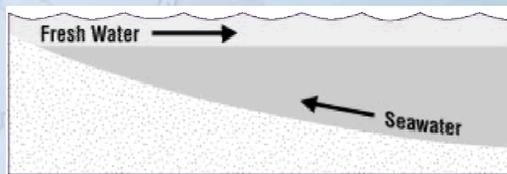


# An Estuary

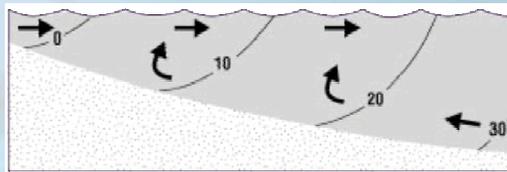
- Semi-enclosed coastal body of water
- Free connection with open sea
- Measurably diluted with fresh water



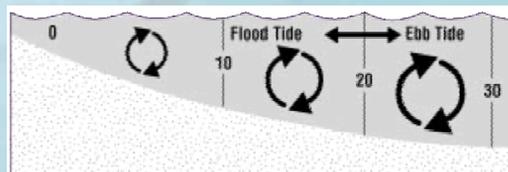
▪ Highly Stratified



▪ Moderately Stratified



▪ Vertically Mixed



## The Importance of Estuaries

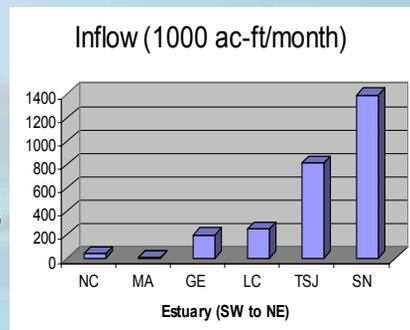
- Habitat
- Nursery
- Productivity
- Water Filtration
- Flood Control
- Economy
- Culture



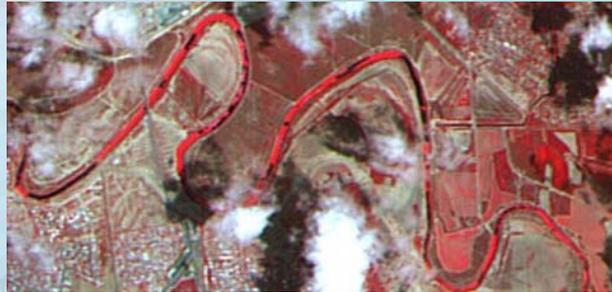
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## Freshwater Inflow

- Estuary health dependent upon freshwater loading:
  - Salinity
  - Base of food web
  - Removal of pollutants
- Gulf of Mexico receives 1.11 trillion m<sup>3</sup>/yr

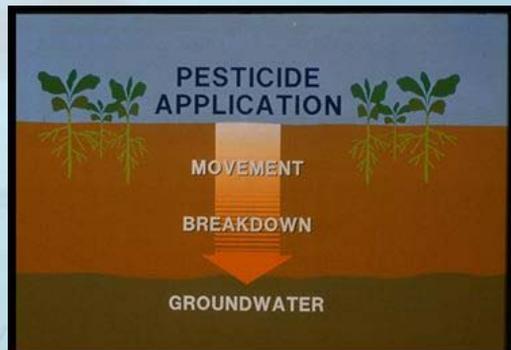


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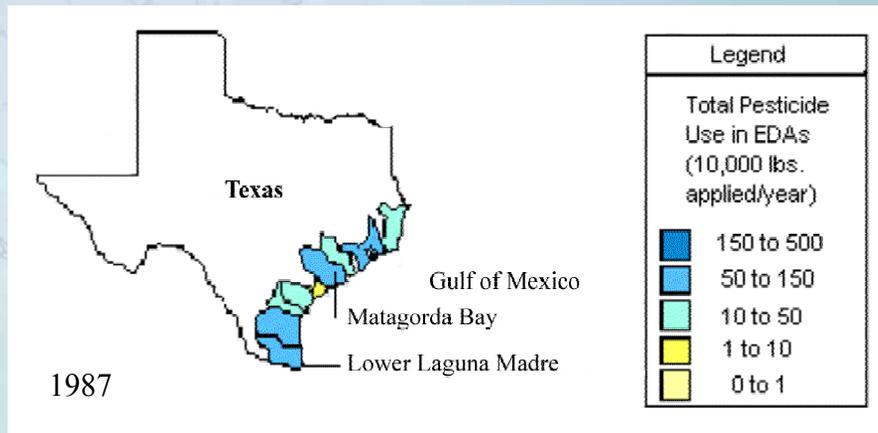


## Pesticides

- Cost: \$376 million
- Amount: 2.4 - 8 million lbs. active ingredients
- Source:
  - Agriculture
  - Municipalities
- Effects



## Agricultural Pesticide Drainage Areas



## Fertilizers

- Cost: \$642 million
- Runoff Amount:
  - Nitrogen: 6.8 million tons
  - Phosphorous: 2.6 million tons
- Sources:
  - Agriculture
  - Municipalities
- Effects



## Sediment Contamination

- Variety of sources
- Settle at the bottom of estuaries
- Two types:
  - Heavy metals
  - Organics
- Tend to:
  - Bioaccumulate
  - Biomagnify
  - Affect biodiversity



## Heavy Metals

<i>Most Common Heavy Metals</i>	<i>Sources</i>				
	<i>Industrial Runoff</i>	<i>Corrosion of Alloys</i>	<i>Electroplating Byproducts</i>	<i>Exterior Paints</i>	<i>Fossil Fuel Combustion</i>
<b>Arsenic (As)</b>	✓				✓
<b>Cadmium (Cd)</b>	✓	✓	✓		
<b>Chromium (Cr)</b>	✓	✓	✓	✓	
<b>Copper (Cu)</b>		✓	✓	✓	
<b>Lead (Pb)</b>				✓	
<b>Mercury (Hg)</b>	✓				
<b>Zinc (Zn)</b>				✓	

## Effects of Heavy Metals

- Copper:

- Blue Crab
- Causes molting problems



- Mercury:

- Mollusks
- Lavaca Bay mussels have extremely high levels of mercury due to chlor-alkali factory discharge
- Unsuitable for human consumption

## Organics

Most Common Organic Pollutants	Sources				
	Runoff			Petroleum Products	Naturally Occurring
	Agricultural	Industrial	Urban		
Chlorinated Pesticides	✓		✓		
PAHs			✓	✓	✓
PCBs		✓			
Nutrients	✓		✓		✓
Bulk Organics	✓			✓	

## Effects of Organic Contamination

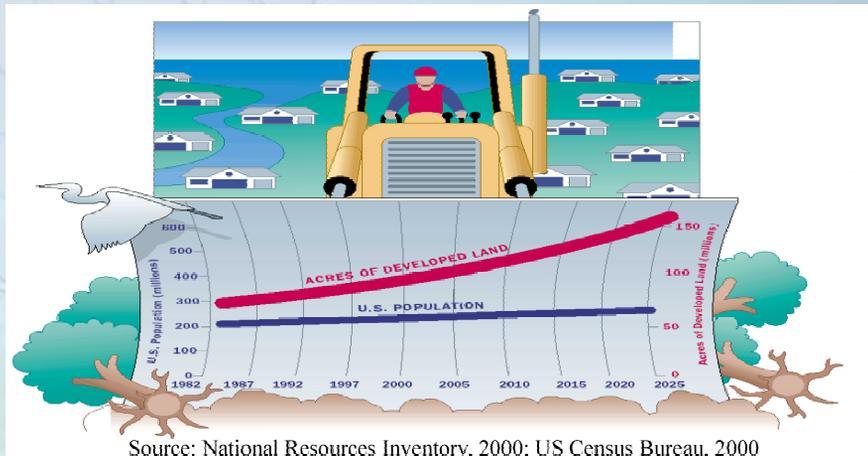
- Excessive exposure to PAHs may cause tumors and deformities
- Oil spills:
  - Directly:
    - Poison when ingested
    - Destroy spawning locations
  - Indirectly:
    - Affect organisms in the larval stages



- Excess Nutrients
  - Prompt algal blooms
  - Speed up eutrophication



# Disproportionate Growth



Source: National Resources Inventory, 2000; US Census Bureau, 2000

## Estuarine Consumption

- Environmental health is a function of consumption
- Land is currently being developed at 2.5 times the rate of population growth
- Impervious materials prevent natural runoff



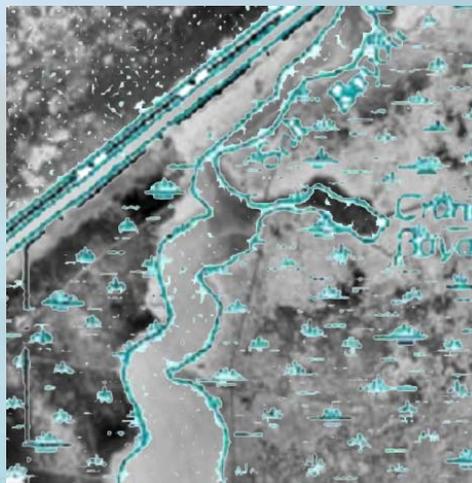
## Case Studies

- Salt Bayou
- Aransas NWR Shoreline
- Bahia Grande



## Salt Bayou

- April 1991 - November 1995
- Participants:
  - U.S. Army Corps of Engineers
  - Texas Parks and Wildlife
  - Ducks Unlimited
  - Galveston District
- Cost: \$2,405,900



## Aransas NWR Shoreline

- 1989 - 1992
- Participants:
  - U.S. Fish and Wildlife Service
  - U.S. Navy
  - U.S. Army Corps of Engineers
  - National Marine Fisheries Service
  - Texas Parks and Wildlife
  - Texas Department of Transportation
- Cost: \$25,000

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## Bahia Grande

- Currently on-going
- Participants:
  - Ocean Trust
  - Ducks Unlimited
  - Gulf of Mexico Foundation
  - NOAA Fisheries
  - NOAA Comm. Based Restoration Program
  - Gulf Ecological Sites Management Program
  - U.S. Fish and Wildlife Service
  - Texas Coastal Program

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## Largest Wetland Reclamation Project in the World



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## Local Action

- Further knowledge through high school courses
- Help federal and non-profit organizations monitor estuaries
- Sponsor small-scale community projects



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# Policy Recommendations

## Education:

- Encourage governments of coastal states to incorporate an Environmental/Earth/Ocean Science course to high school graduation requirements
- Enforcement agencies should offer a course in environmental awareness in lieu of fine payments for violators of coastal regulations

- In order to receive full federal funding, a portion of the curriculum in Head Start Programs should be devoted to fostering an awareness of the local environment

## Freshwater Inflow:

- A long-term freshwater usage plan should be adopted that protects downstream estuary maintenance and human consumption during both wet and dry periods.



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## Fertilizer/Pesticide Usage:

- Federal agricultural subsidies should be dependent upon the recipient's chemical usage documentation.
- Continue to implement Best Management Practices (BMP's)



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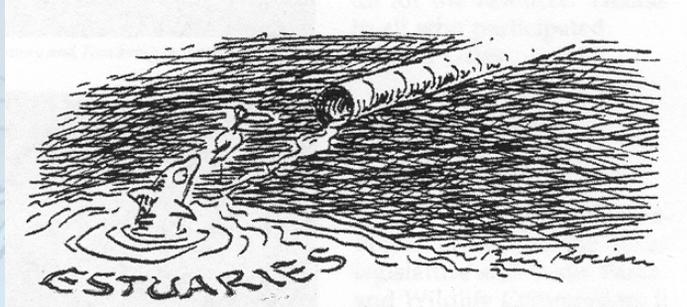
## Contaminants:

- Coordinate the monitoring of estuarine life for the presence of toxins such as PAHs and mercury
- Data should be relayed to the FDA when excessive levels arise so that the general public can be alerted

## Urban Development:

- Create a Coastal Enforcement Department within the U.S. Army Corps of Engineers
- Encourage local governments to develop sustainable urban development departments
- Develop a cooperative initiative with Mexico on wastewater management to prevent inflow into both fresh and coastal water supplies

# Estuary Degradation



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